

Completion and Initial Use of the 100-MeV Isotope Production Facility

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The design and construction of the 100-MeV Isotope Production Facility (IPF)¹ at the Los Alamos Neutron Science Center (LANSCE) began in November 1998. The project is currently 90% complete. During 2002, modifications were made to the existing H⁺ main accelerator beam line in the transition region between the drift-tube linear accelerator (DTL) and the side-coupled cavity linac (SCL). The proton beam used to produce the radioisotopes is extracted from this transition region. Also, three distinct systems comprising a new facility under construction were assembled: (1) building structures above and below ground to house the special facility equipment; (2) a new accelerator beam line; and (3) target-insertion and -retrieval hardware and a hot cell to handle the irradiated targets.

Remaining work includes installation of the target-insertion and -retrieval hardware, installation of the target controls, and installation of the beam-line instrumentation and control. A Laboratory Readiness Assessment will be completed before the facility is authorized for operations. We expect that these efforts will be concluded in FY 2003, at which time the facility will be ready to accept H⁺ beam for isotope production.

Isotope Production

The new IPF target assemblies will consist of three targets arranged in a stacked configuration in the target holder. They will be thick enough to stop the beam within the last target in the assembly. The individual target thickness will be determined by the energy range to be deposited in each target in the stack. Water will flow between the subassemblies in the stack to cool the targets. The thickness of the water channels is important not only in achieving effective heat transfer but also in obtaining the desired amount of beam-energy degradations for subsequent targets. We have developed a model for the target box and for specific target subassemblies, and we are modeling the performance and survivability of targets in this environment. The results of these calculations will help with the design of initial target irradiations and minimize the potential for target failures during early operations.

We are also investigating the types of target materials and the yields that may be expected for typical production irradiations. Several proposed target stacks are given in Fig. 1 with yield data and other information. Our initial efforts are directed at isotopes with commercial applications and revenue potential (i.e., strontium-82 and germanium-68) and at isotopes that have been selected for production as a result of the Nuclear Energy Protocol for Research Isotopes (NEPRI) process. The strontium-82 and germanium-68 isotopes are essential for the clinical application of positron-emission tomography, and most of the research isotopes have potential applications in nuclear-medicine diagnosis and therapy. As the NEPRI process matures, we expect that more research isotopes will be added to the portfolio of products produced at the LANSCE 100-MeV IPF.

	Target Stack #1			Target Stack #2			Target Stack #3			Target Stack #4		
Beam current (μA)	125	125	125	125	125	125	125	125	125	125	125	125
Bombardment time (days)	4.00	4.00	4.00	20.00	20.00	20.00	2.00	2.00	2.00	2.00	2.00	2.00
Target	RbCl	RbCl	Ga	NaCl	Mg	Ga	Cr	Zn	W-186	Nb	Zn	W-186
Isotope	Sr-82	Sr-82	Ge-68	Si-32	Na-22	Ge-68	V-48	Cu-67	Re-186	Zr-88	Cu-67	Re-186
Half-life (days)	25.5	25.5	25.5	62823	950.7	270.82	15.97	2.6	3.72	83.4	2.6	3.72
Production rate (mCi/ μAh)	0.130	0.230	0.032	0.000	0.024	0.032	1.100	0.115	0.050	0.235	0.115	0.050
Yield at EOB* (mCi)	1478	2615	382	0.0180	1436	1872	6322	534	250	1398	534	250
Decay time (days)	12.00	12.00	12.00	14.00	14.00	14.00						

* End of bombardment

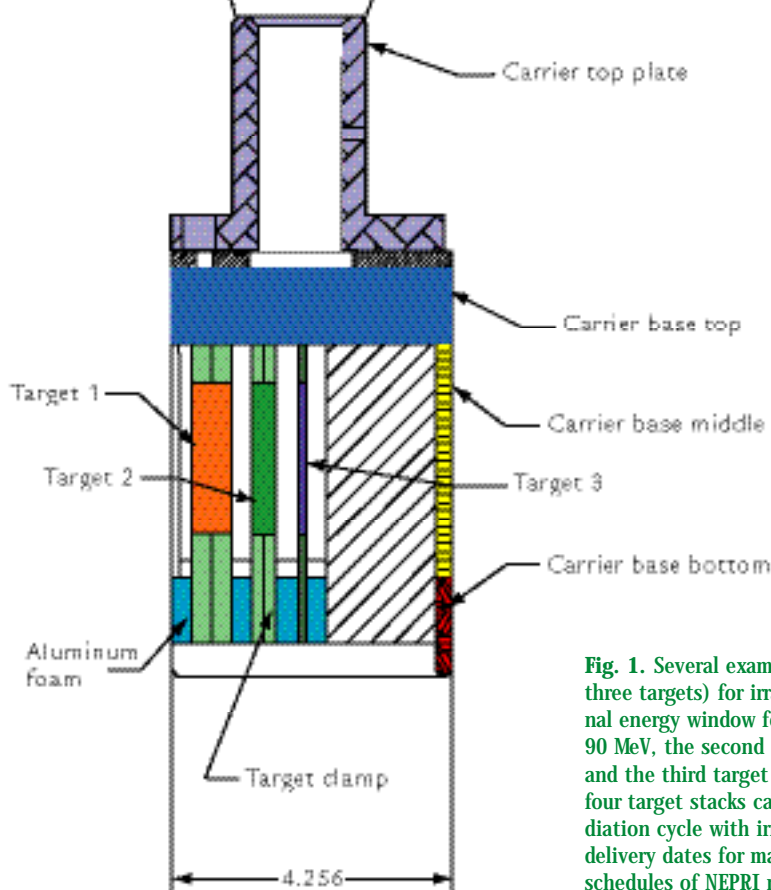


Fig. 1. Several example target stacks (each stack having three targets) for irradiation in the 100-MeV IPF. The nominal energy window for the first target per stack is 70 MeV to 90 MeV, the second target per stack is 45 MeV to 65 MeV, and the third target per stack is 10 MeV to 30 MeV. These four target stacks can be irradiated in a typical 28-day irradiation cycle with irradiations scheduled depending on delivery dates for major revenue isotopes or experimental schedules of NEPRI research customers.

Acknowledgements

The researchers would like to acknowledge the U.S. Department of Energy Office of Nuclear Energy, Science, and Technology and Office of Isotopes for Medicine and Science for financial support both for the line-item construction project and for operating funds for isotope-production infrastructure support.

References

1. R.C. Heaton and E.J. Peterson, Los Alamos National Laboratory report LALP-01-258; <http://lansce.lanl.gov/research/pdf/IPF.pdf>.

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Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the University of California for the U.S. Department of Energy under contract W-7405-ENG-36.